



# **Development Density Options and Recommendations**

**Shoreland Lot Sizes  
Impervious Surfaces  
Nonconforming Lots  
Setback Averaging**

June 24, 2003 Advisory Committee Meeting

# Impervious Surfaces

Kevin Kirsch, DNR

June 24, 2003

# Impervious Surface Issues

- Can we utilize impervious surface regulations to minimize the cumulative impacts on our water resources from increased development?
- Can we identify a flexible mechanism to regulate impervious surfaces which is responsive to differing lot sizes and supports aesthetic, habitat and water quality goals?

# What Have Counties Done?

Current state law does not regulate the amount of impervious surface area on a shoreland lot; however, several counties have been regulating impervious surfaces as a unique way to limit surface water runoff and increase infiltration.

Examples include:



# What Have Counties Done?

- Some counties set an impervious area cap on a per lot basis.
- A few counties refined the standard to include separate limits for buildings and for other impervious surfaces.
- Another option is to regulate impervious areas at a threshold beyond a certain distance from the water. Shawano County limits impervious area to 8% of lot area within 300 feet of the ordinary high water mark for White Lake.

# Impacts of Not Regulating Impervious Surfaces

Impervious areas increase the amount of runoff as well as its velocity and may cause:

- greater fluctuations in water levels
- increased erosion
- increased sediment and pollutant loads to waterways
- degraded stream habitat (e.g. gravel spawning areas filled with sediment)
- increased temperature and loss of sensitive cold water fish
- decline in fish diversity
- reduced spawning of fish

# Guiding Principles

- Regulating impervious surfaces will help to account for cumulative impacts to our waterbodies
- Limiting impervious surface area is an important tool that will protect water quality, wildlife habitat and the natural aesthetics of our aquatic resources.

# Recommended Regulations

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- A. Impervious surfaces shall not exceed 20% of the entire lot within the shoreland zone.
- B. Impervious surfaces shall not exceed 2,500 square feet or 20% of the entire lot within the shoreland zone.
- C. Impervious surfaces shall not exceed 5% unless 90% of post construction runoff controlled.**
- D. No impervious surface cap.

# Impacts of Impervious Area

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Impervious areas include roof tops, pavement, compacted earthen material, and other surface which impede the natural infiltration of stormwater.



## Impacts of Imperviousness on Surface Water and Groundwater Quantities

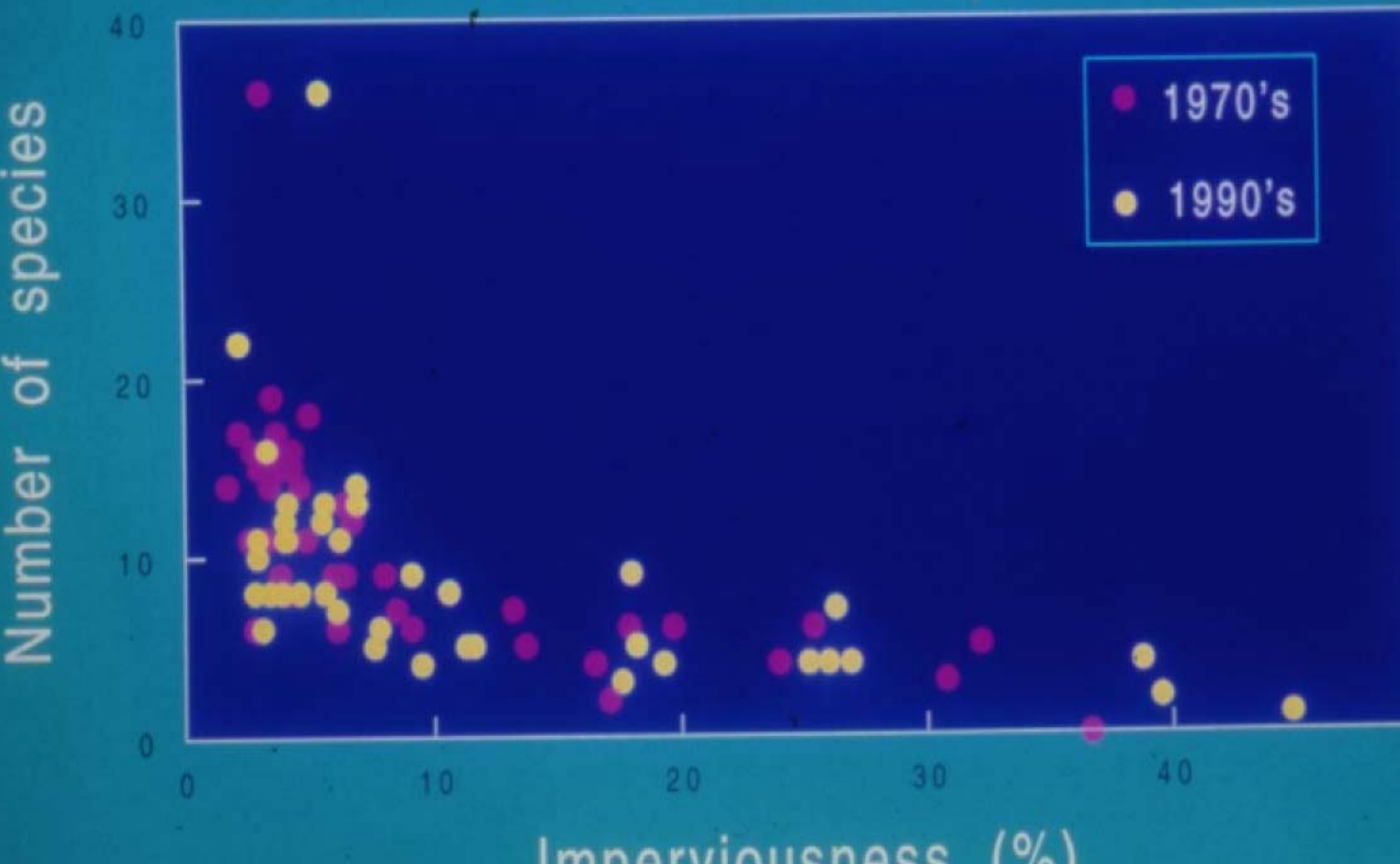
| Type of Water Resource | Impervious Increase from 2% to 18% | Impervious Increase from 2% to 60% |
|------------------------|------------------------------------|------------------------------------|
| Stream Baseflow        | -20%                               | Dry Stream                         |
| Surface Runoff         | +90%                               | +485%                              |
| Regional Groundwater   | -10%                               | -55%                               |
| Spring Flow            | -5%                                | -30%                               |



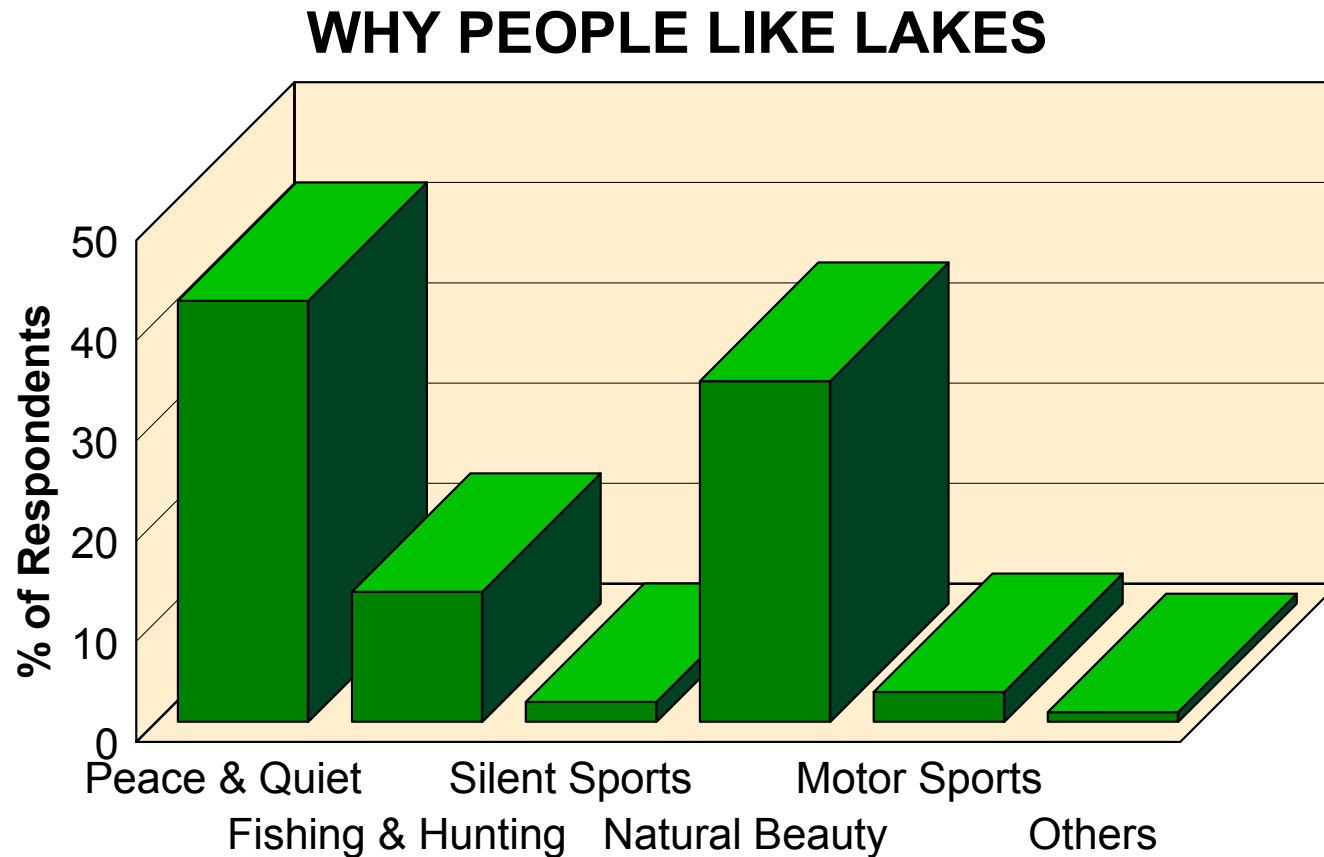




# Relationship between imperviousness and number of fish species

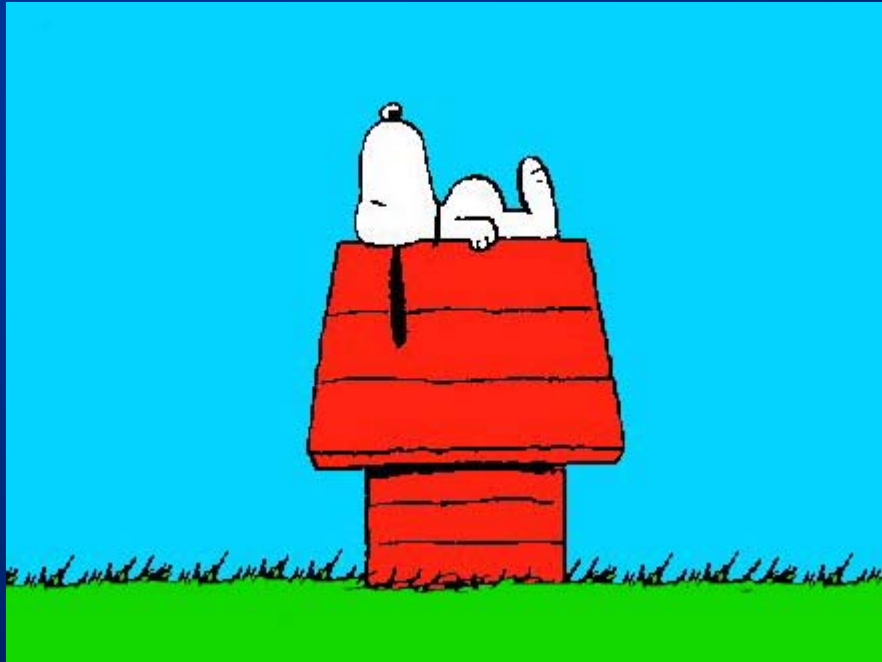


# Why People Like Lakes

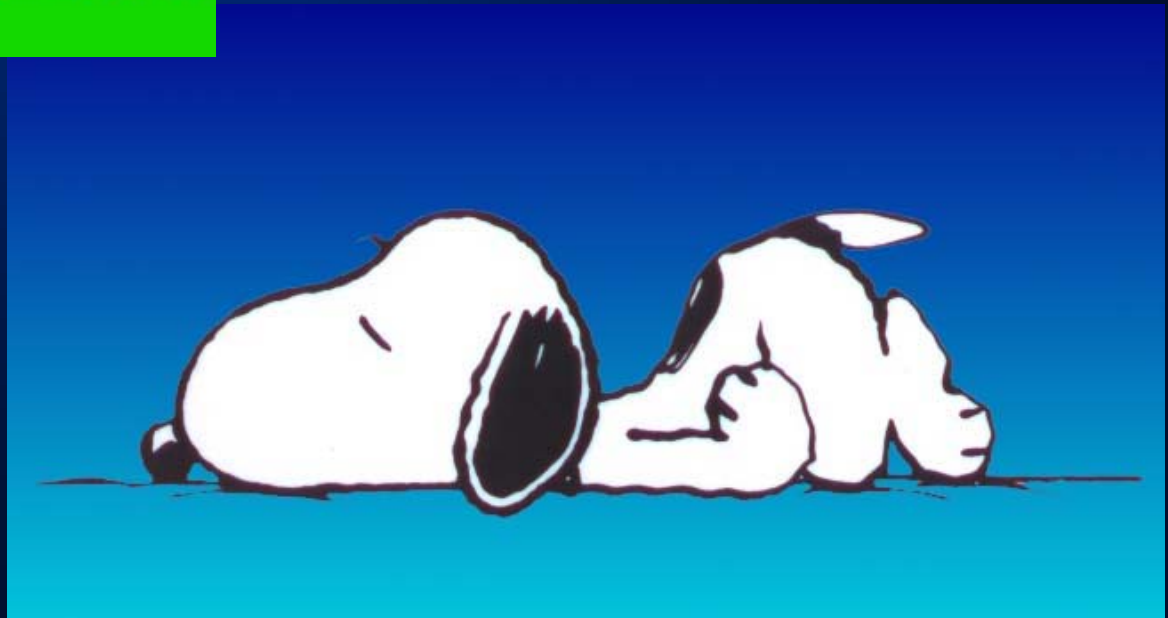


From a survey in Lake Tides newsletter  
published by U. Wisconsin Extension





We Haven't Been  
Sleeping  
On The Job

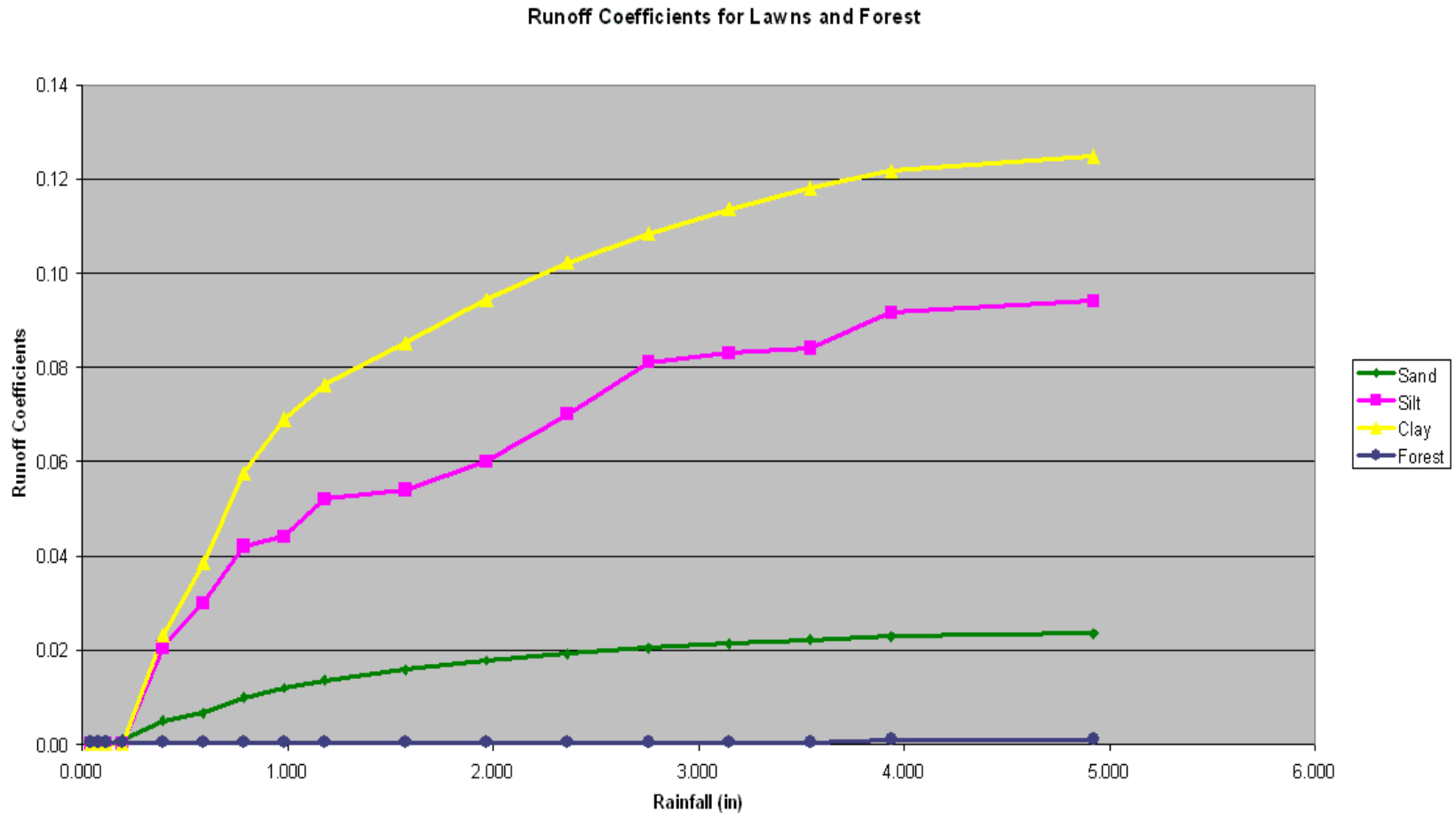


# Modeling to Evaluate Impervious Cover

Used SLAMM to evaluate runoff and pollutants from typical shoreland development.

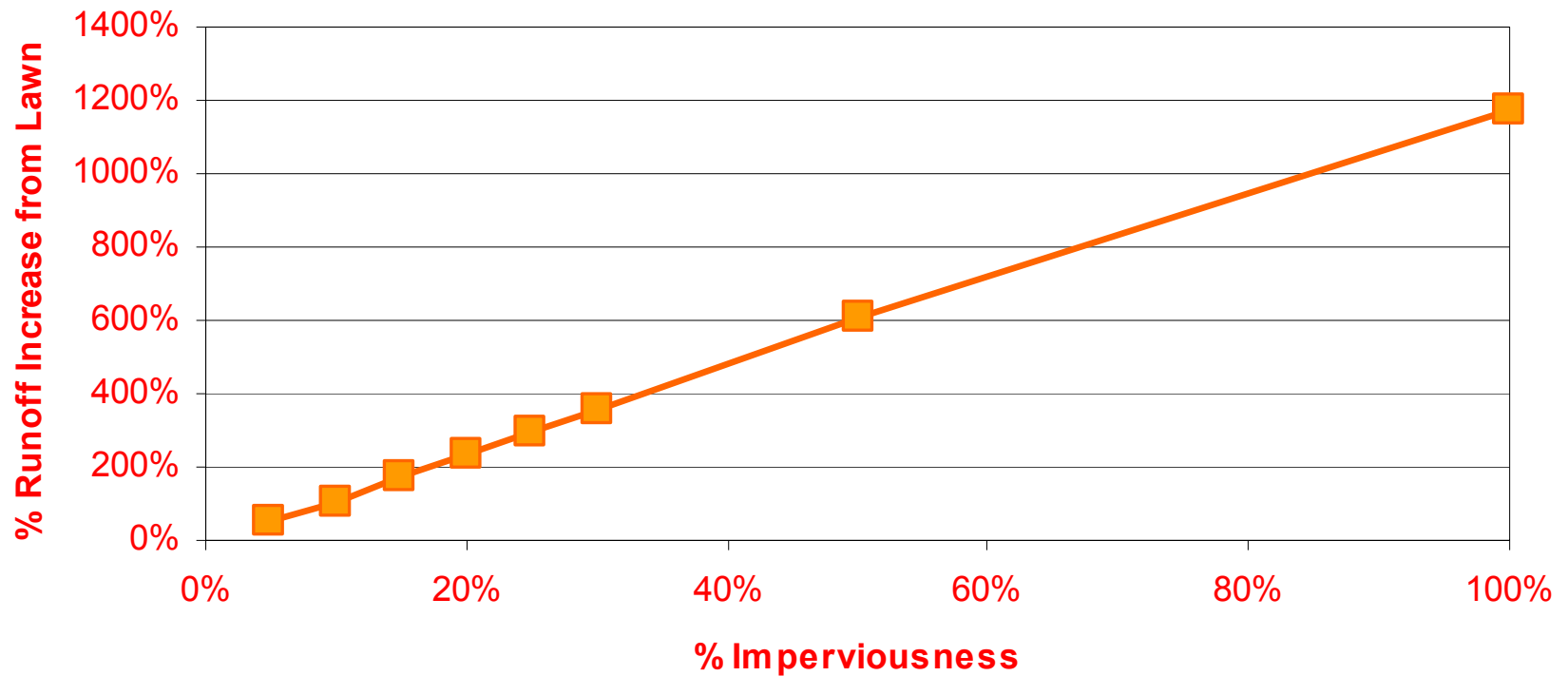
- 20,000 square foot lot
- Average Wisconsin rainfall
- Conservative soil characteristics

# Modeling Results



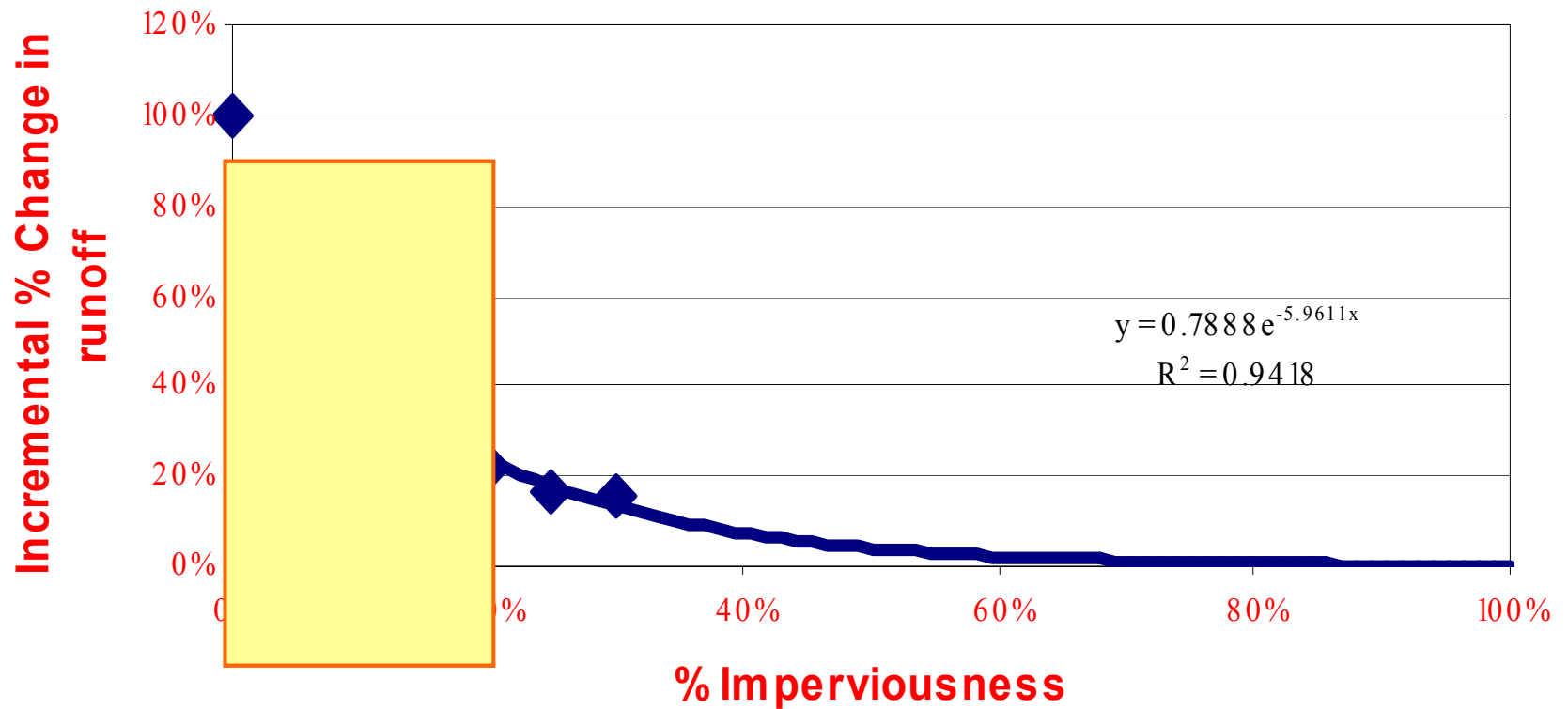
# Modeling Results

**Increasing Runoff due to Increasing Imperviousness**



# Modeling Results

## Incremental Change as Imperviousness Increases

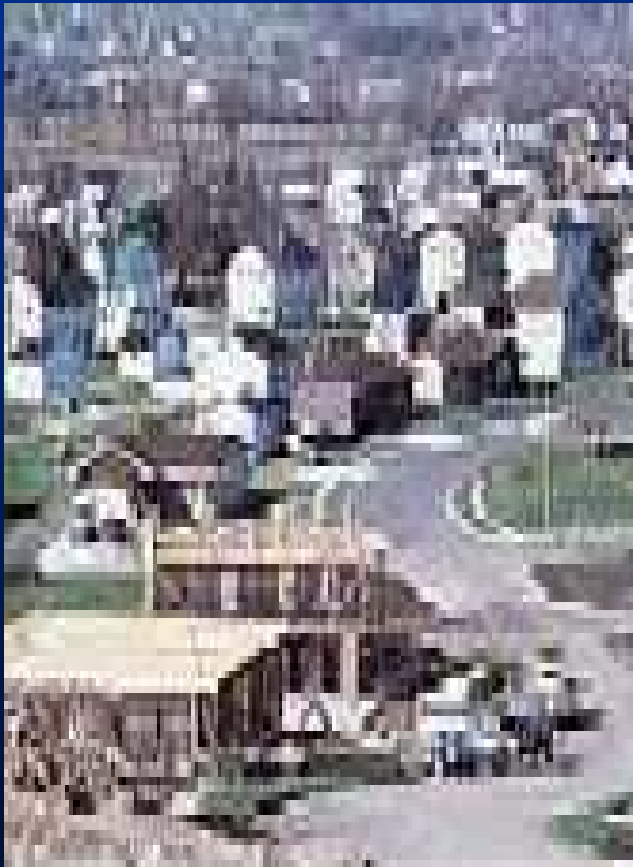




# Modeling Results to Performance Standard

- Similar to NR 151 but simplified for the typical residential shoreline development (Option C)
- *Impervious level set at 5%*
- *Level of control set at 90% with no cap on size of stormwater devices*

# NR 151 Non-Agricultural Post-Construction Standards



## Post-Construction Site Applicability

- Sites subject to construction performance standard
- 2-year implementation delay - planning & bidding procedures
- Some exemptions allowed
- Implemented through existing programs
  - NR 216, TRANS 401

# NR 151 Non-Agricultural Post-Construction Standards

## **Post-Construction Site Standards**

- Written storm water plan
- TSS controlled by design to MEP up to 80%
- 2-year 24-hour peak flow control
- Infiltration standard
- Protective areas (buffers)
- Fuel & maintenance areas (no sheen)

# NR 151 Non-Agricultural Post-Construction Standards

## Infiltration Standard (by design)

- Residential
  - Infiltrate **90%** of the average annual predevelopment infiltration volume or
  - **25%** of the 2-year, 24-hour storm
- Non-residential
  - Infiltrate **60%** of the average annual predevelopment infiltration volume or
  - **10%** of the 2-year, 24-hour storm

# NR 151 Non-Agricultural Post-Construction Standards

## **Infiltration Standard**

- Maximum effective infiltration area required to meet volume requirement
  - Residential: 1% cap
  - Non-residential: 2% cap
- Pre-treat parking lots & roads



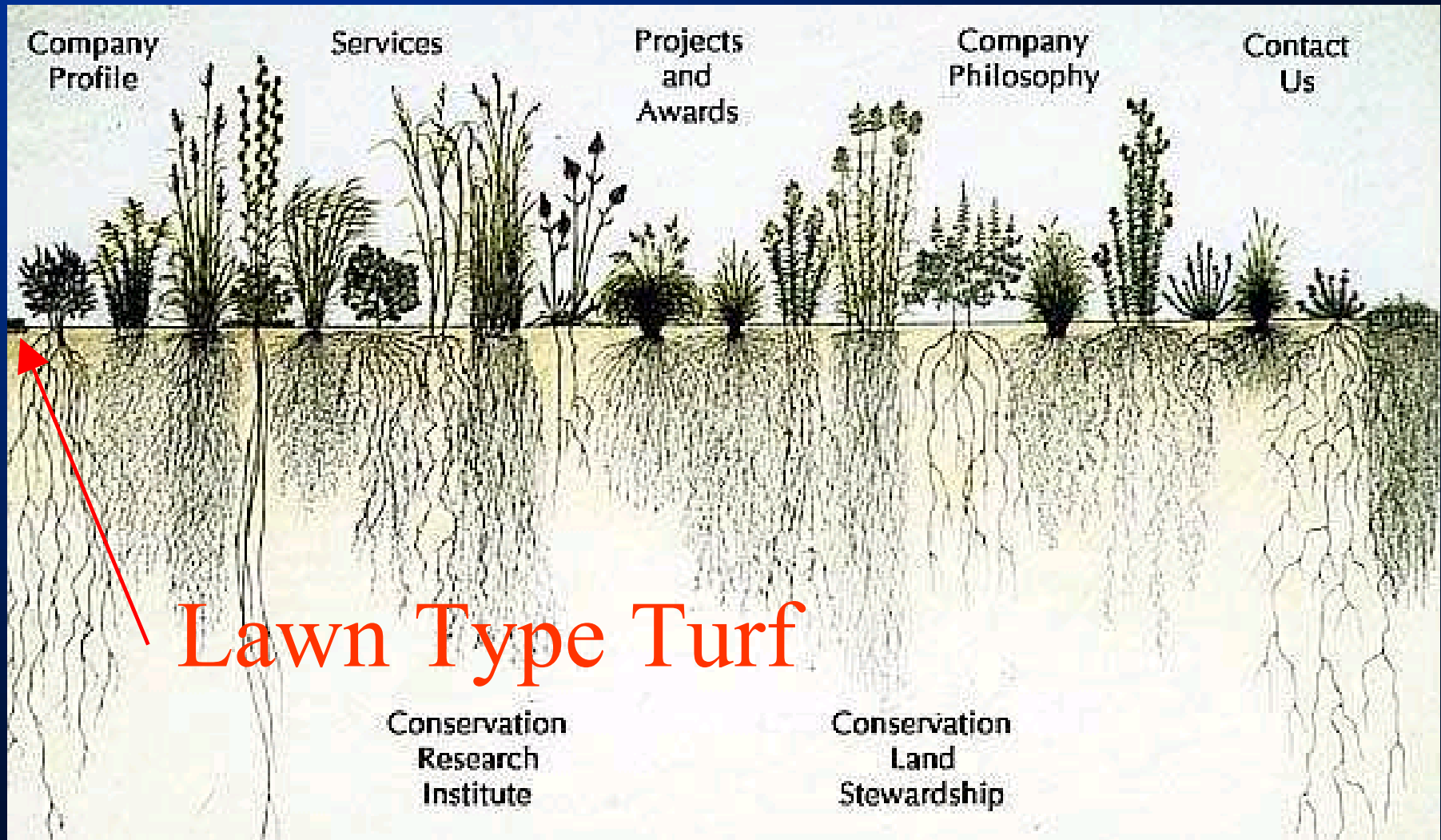
# NR 151 Vs. Conceptual Shoreland Development Standards

- Defining level of control - 90% runoff control versus reference condition to pre-development infiltration
- Requires 90% runoff control versus 80% TSS control and infiltration requirements
- Design matrix of suitable BMPs that meets 90% control requirements

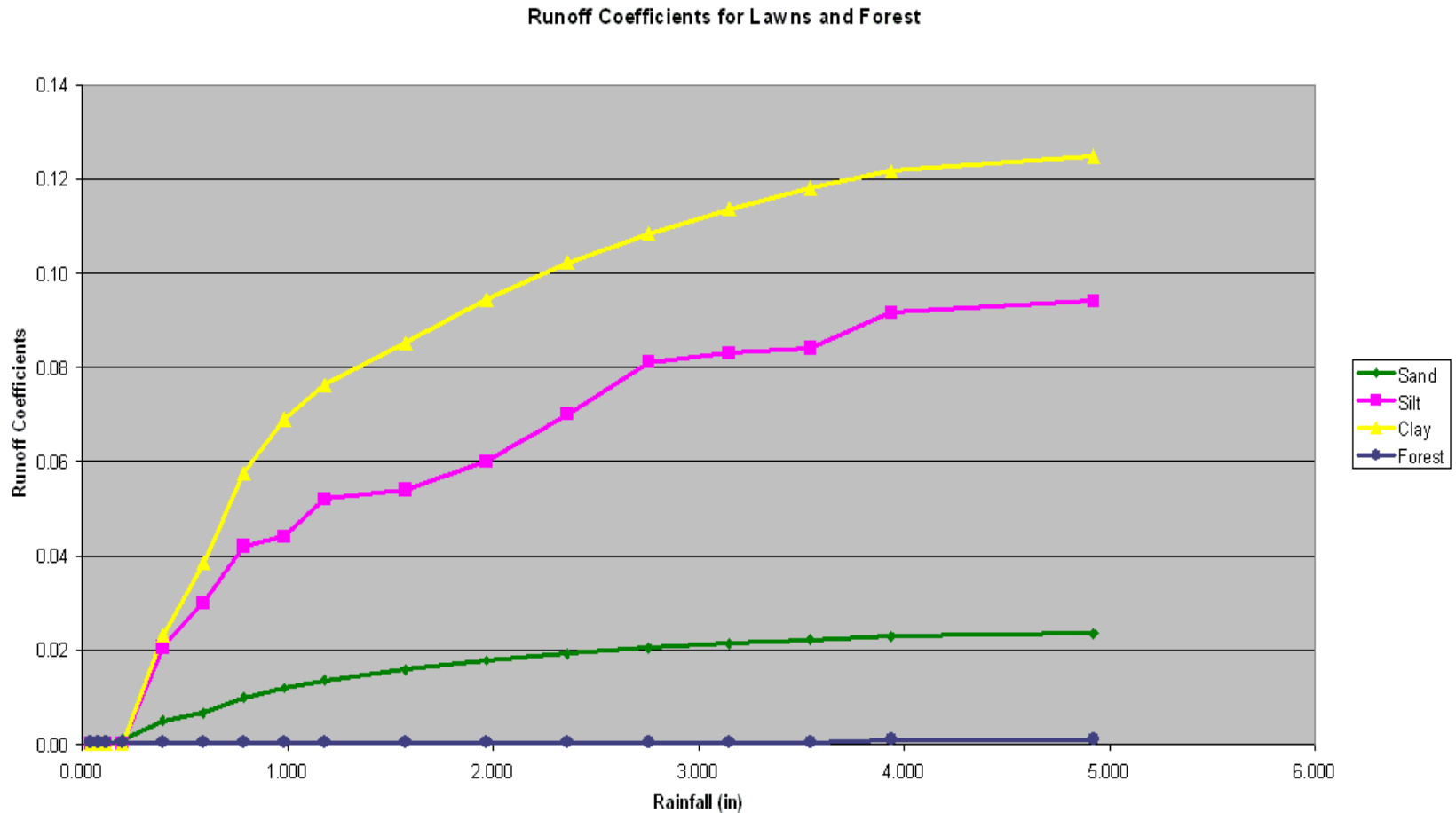
# Potential BMPs for 90% Control

- Conservation Design
- Rain Gardens
- Disconnected Impervious
- Bioretention Basins
- Infiltration and Treatment Swales
- Porous Pavement
- Buffer Strips
- Nutrient Management

# Conservation Design

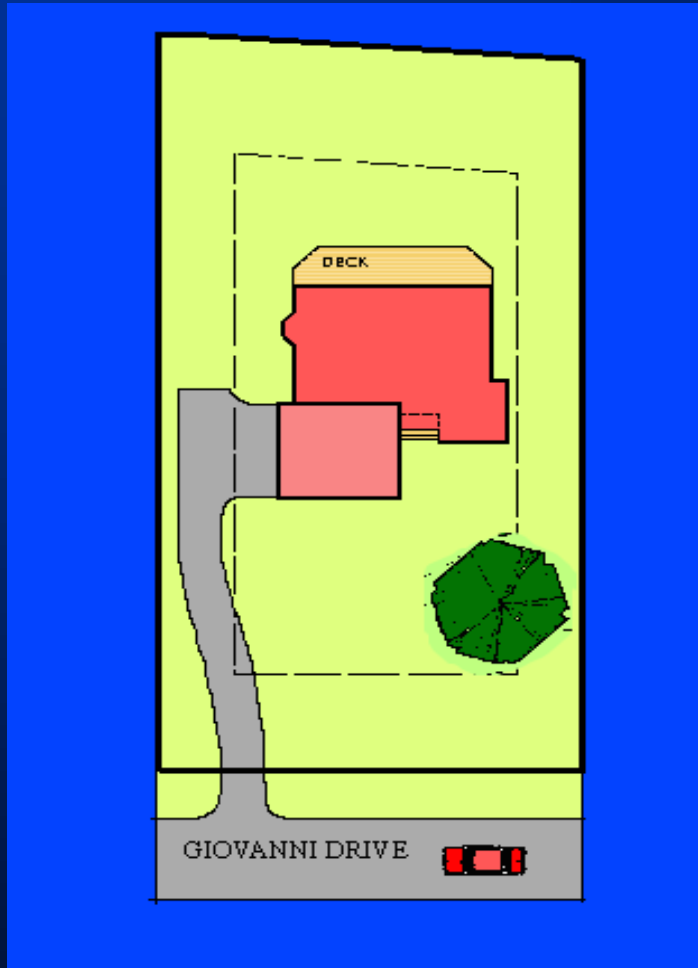


# Conservation Design



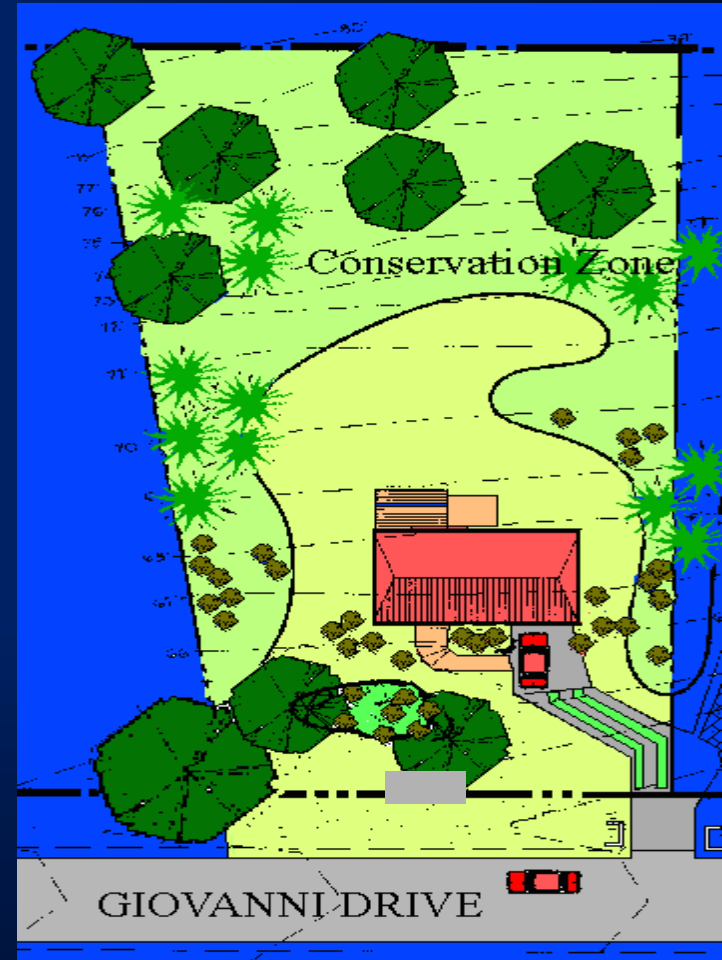
## TRADITIONAL

Avg. Lot Size - 16,800 SF  
Impervious avg. - 24 %



## BMP LOT

Avg. Lot Size - 10,777  
Impervious avg. - 8 %



# LOT COMPARISONS

JORDAN COVE URBAN WATERSHED PROJECT  
Waterford, Connecticut

J. Alexopoulos & J. Clausen

D. Gerwick, Engineering

This project is funded in part by the CT DEP through the US EPA  
Nonpoint Source grant under § 319 of the Clean Water Act





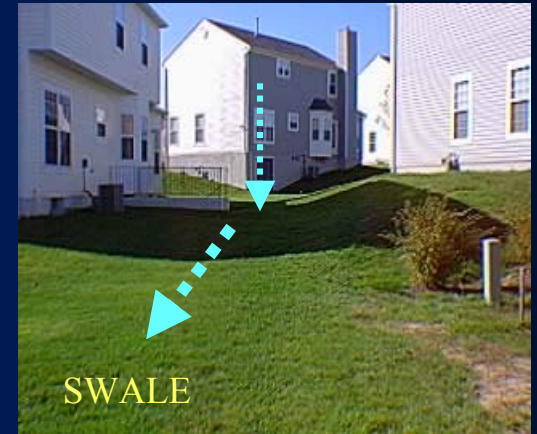
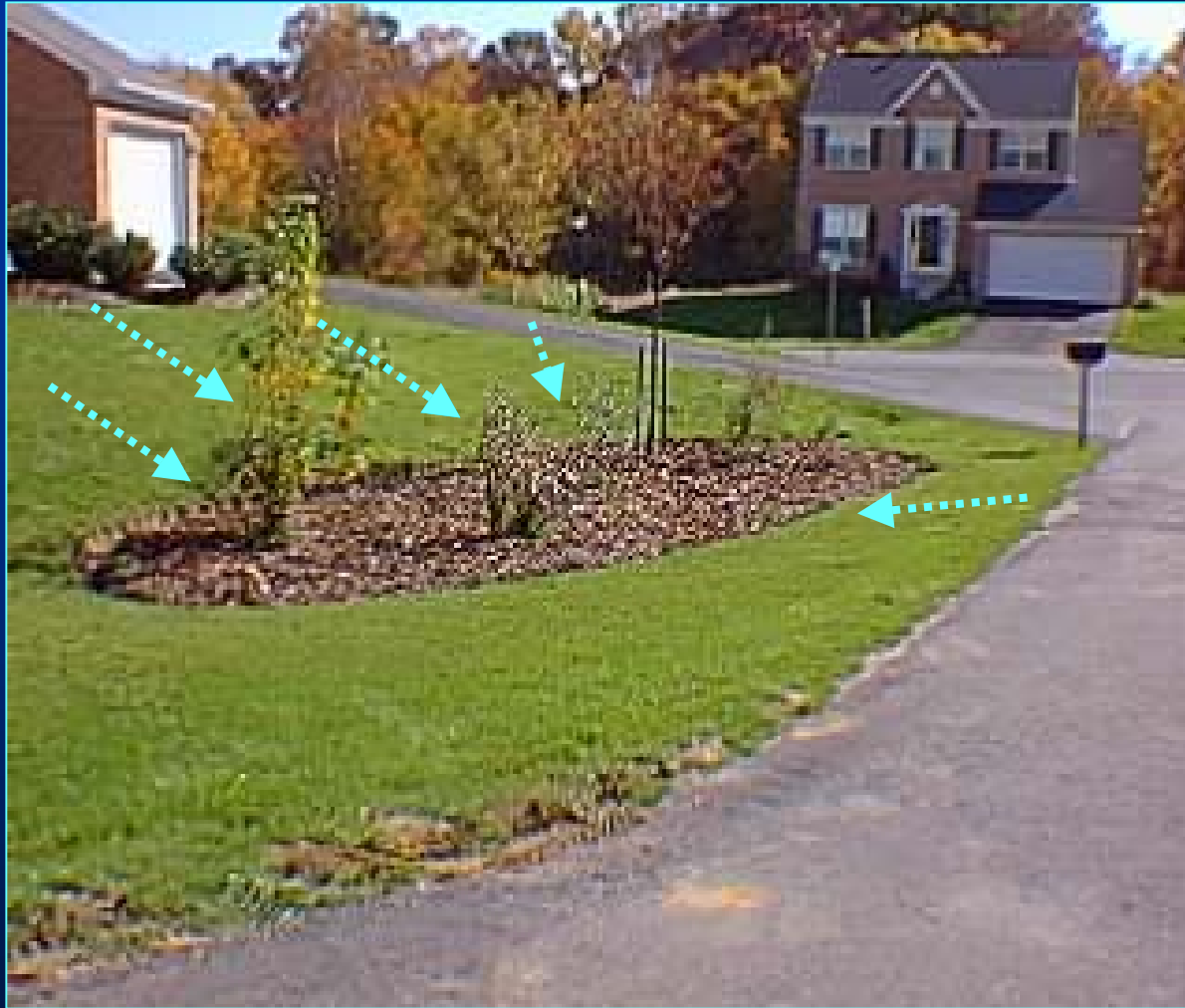


# RAIN GARDENS

A household  
way  
to improve  
water quality  
in your  
community







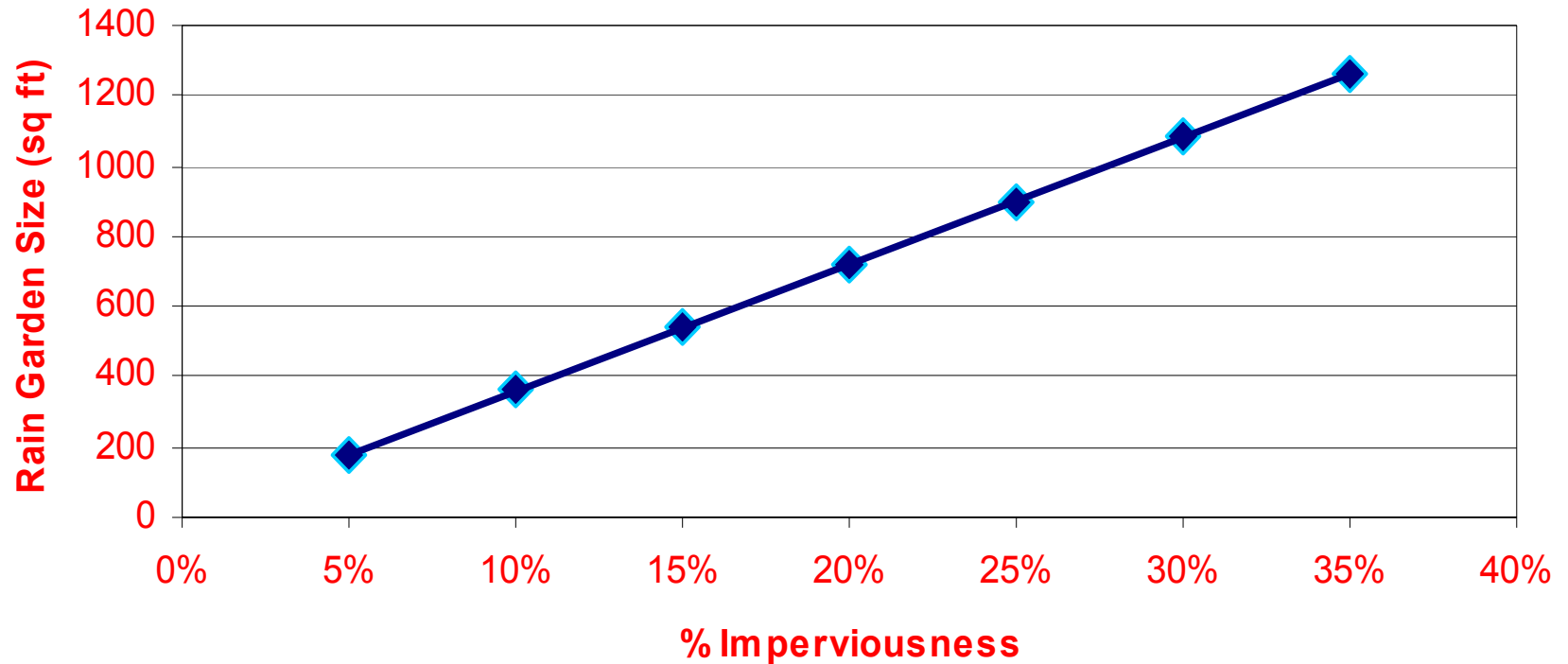
Alexopoulos & Clausen

## RAIN GARDEN EXAMPLES



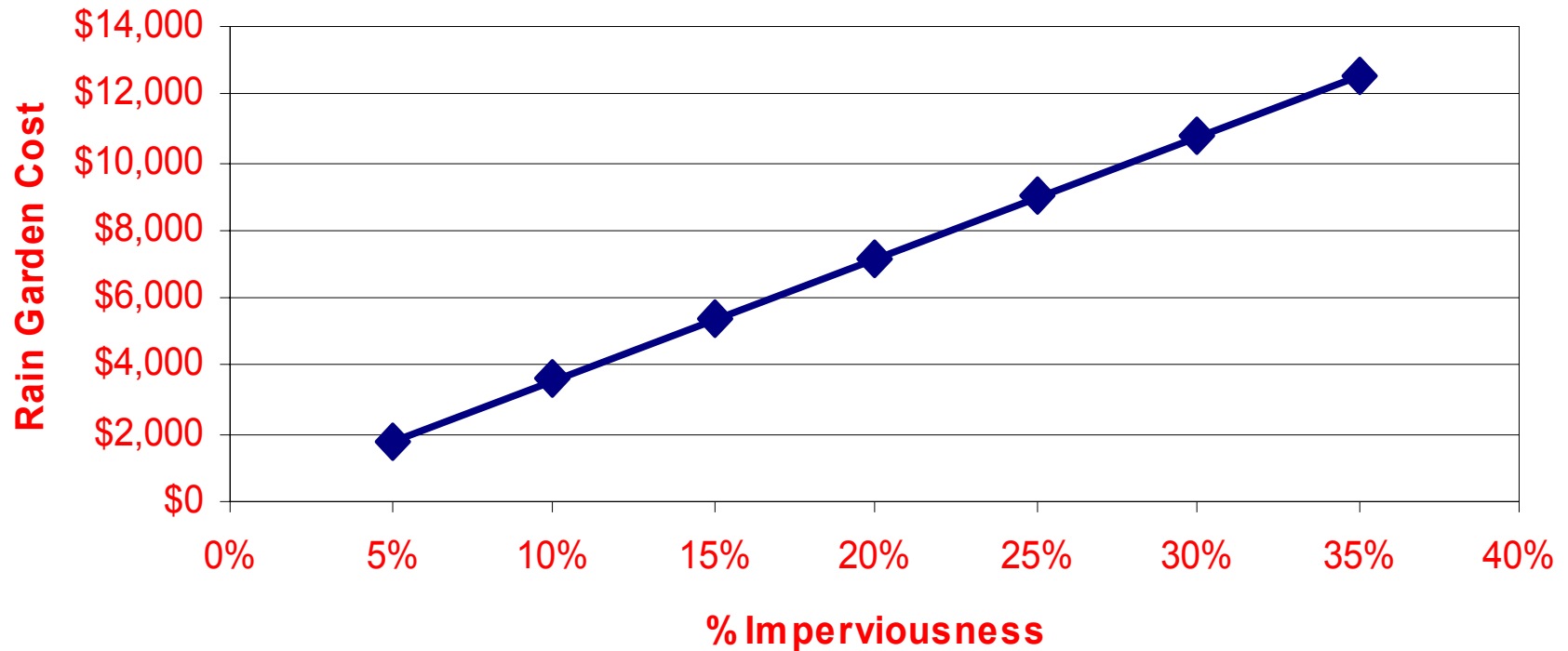
# Rain Garden Modeling Results

**Rain Garden Size:  
90% control on a silt-loam soil**



# Rain Garden Modeling Results

**Rain Garden Cost:  
90% control on silt-loam soil**







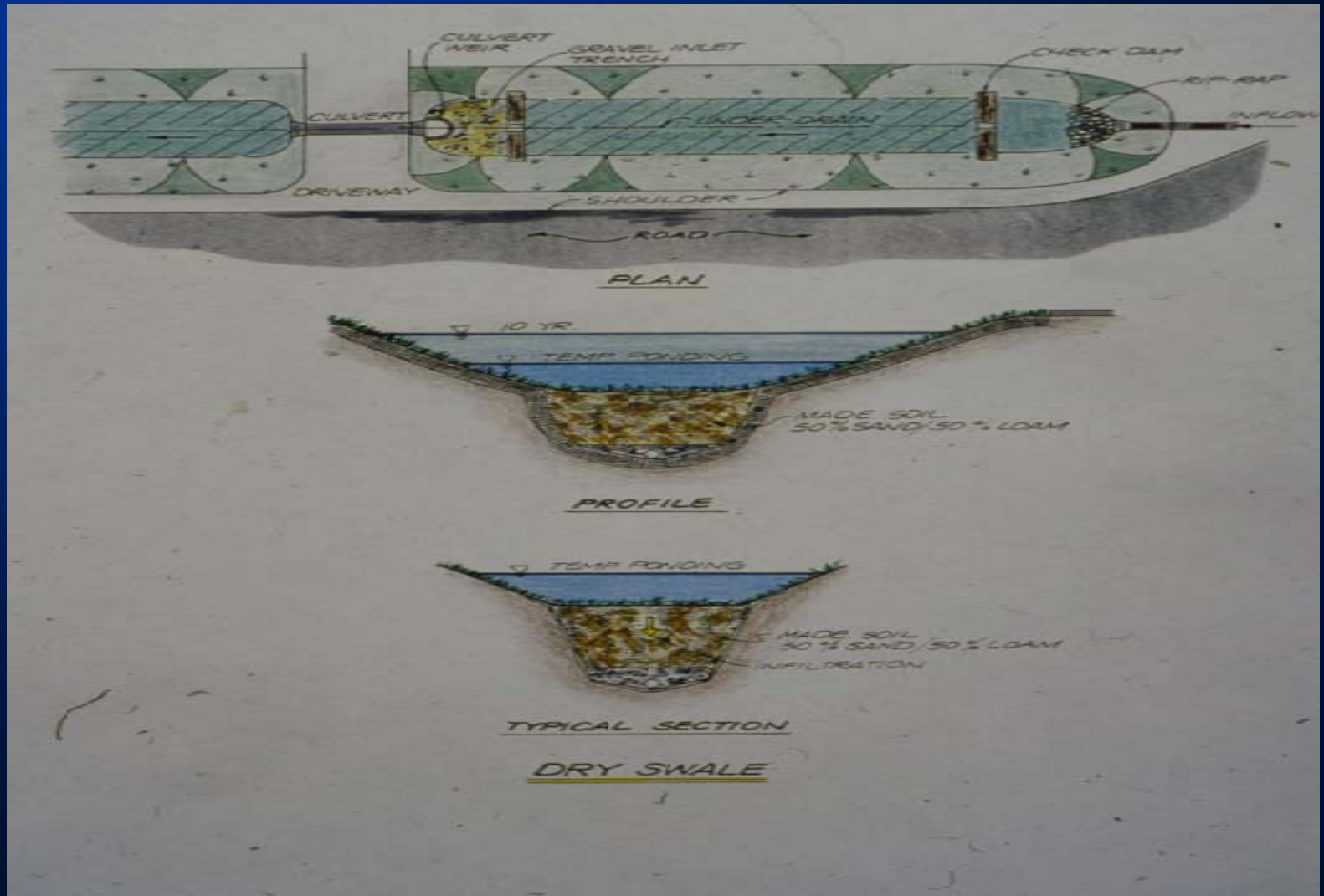
# Disconnect Impervious Areas



# Disconnect Impervious Areas



# Infiltration / Treatment Swales



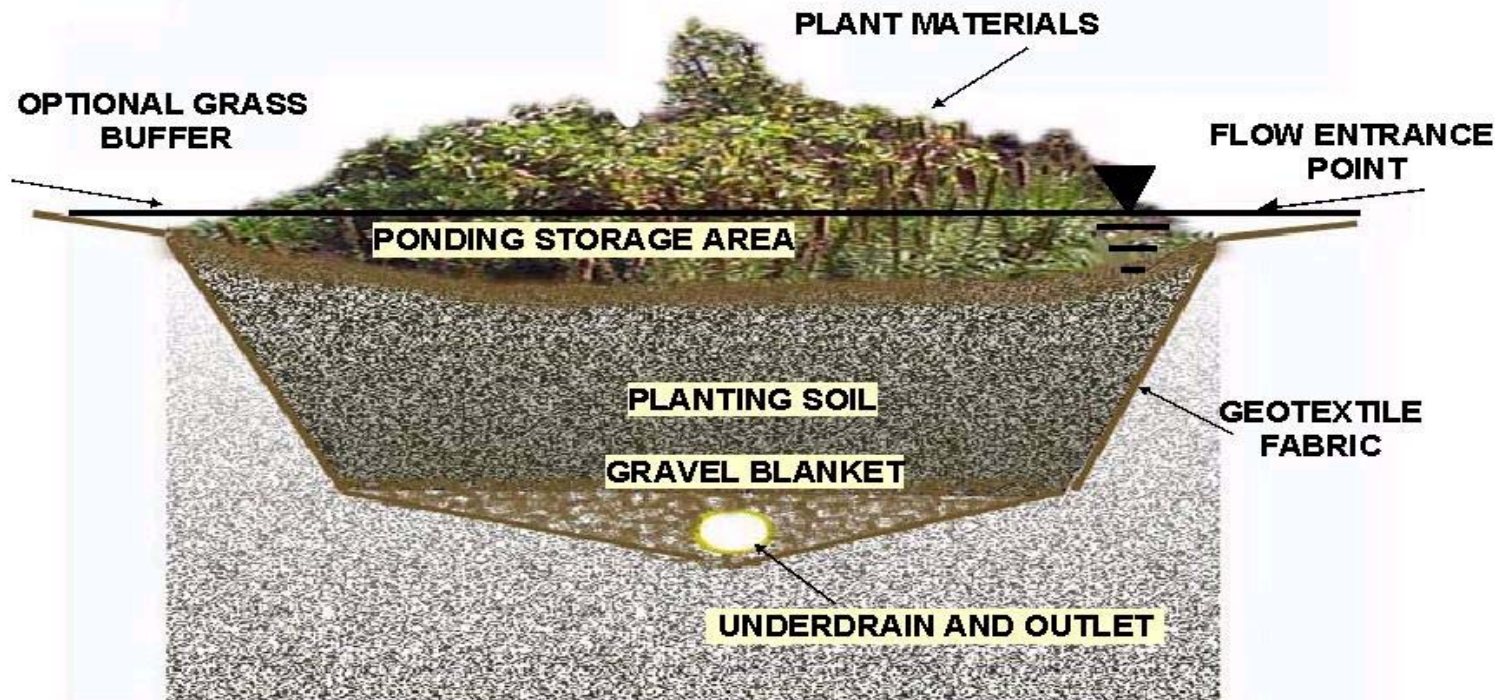


# Porous Pavement and Pavers



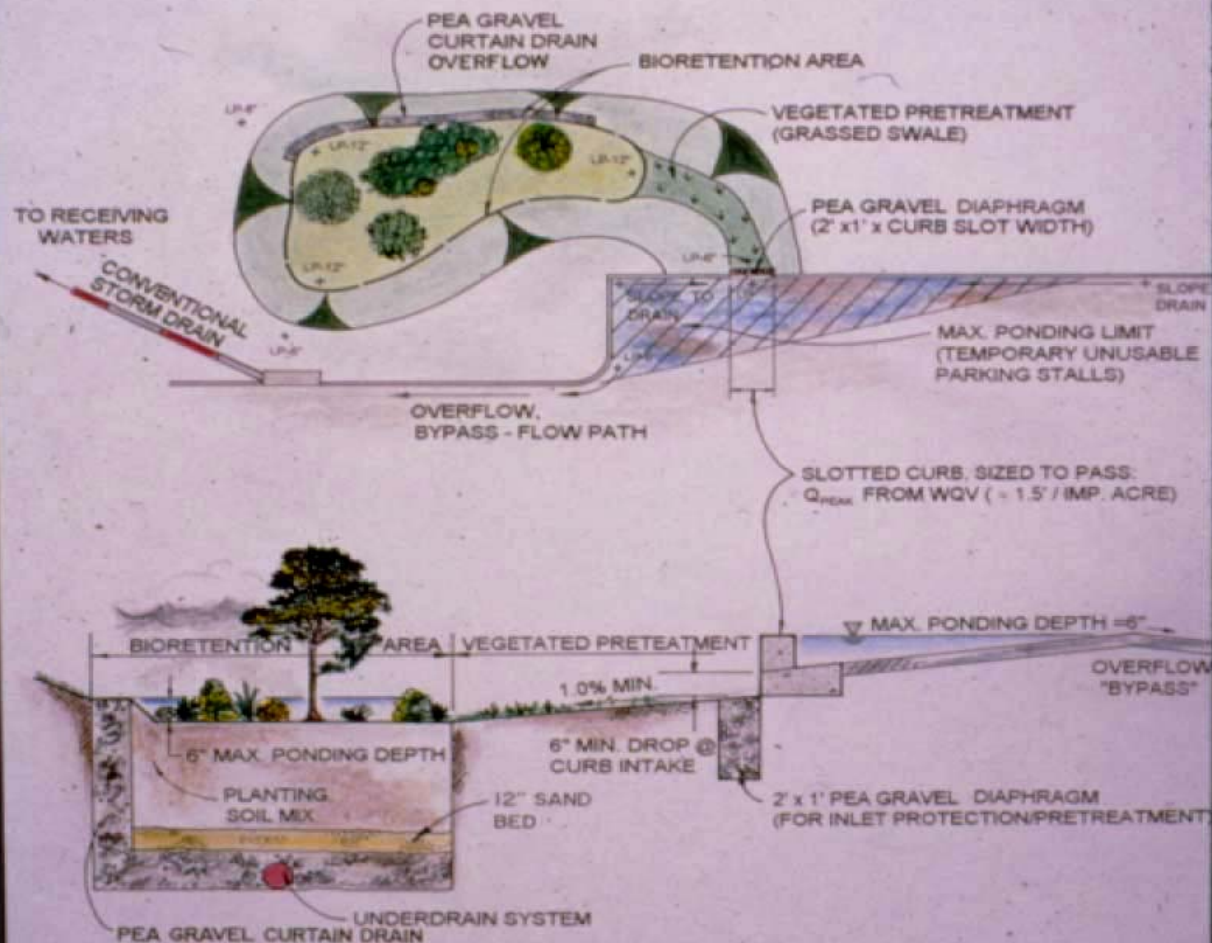
- Driveways
- Parking Lots
- Walkways

# Bioretention Basins









SOURCE: ADAPTED FROM PRINCE GEORGE'S COUNTY -  
DESIGN MANUAL FOR THE USE OF BIORETENTION  
IN STORMWATER MANAGEMENT, 1993



# Shoreland Buffer Strips



**WHY ARE THE  
LITTORAL (NEARSHORE) AND  
SHORELAND ZONES IMPORTANT ?**

# Shoreland Buffer Strips

80% of plants and animals on the endangered species list live all or part of their lives in the littoral zone.

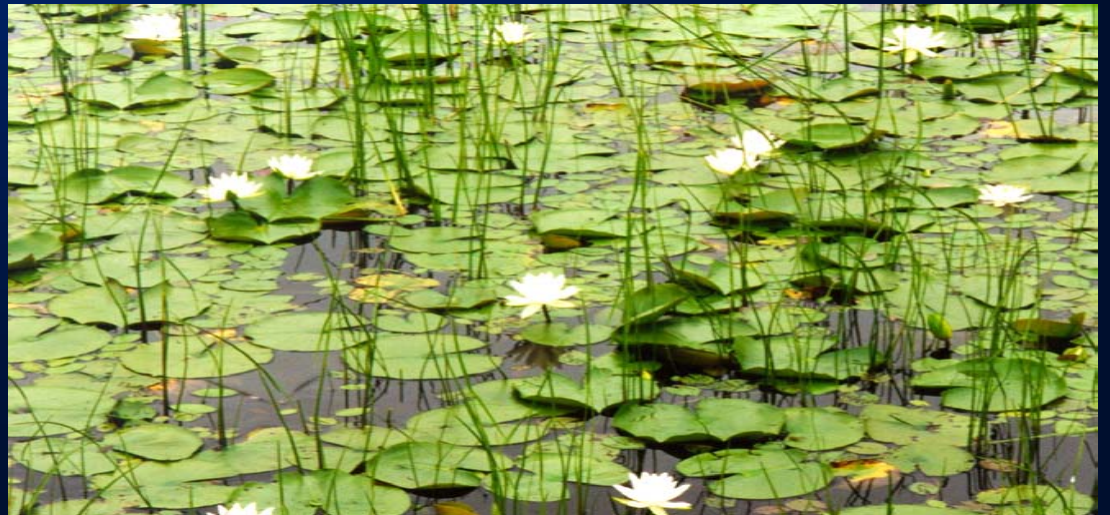
Early results from on-going studies indicate that the development of riparian areas decreases runoff volume and nutrient loading.

# Shoreland Buffer Strips





# Shoreland Buffer Strips



# Nutrient Management



# Recommended Regulations - Revised by AC Members

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- B. Impervious surfaces shall not exceed 2,500 square feet or 20% of the entire lot within the shoreland zone.
- C. Impervious surfaces shall not exceed 5% unless best management practices are implemented to control 90% of post construction runoff.**
- D. No impervious surface cap.



# Recommended Regulations - Revised by AC Members

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- E. Impervious surface cap of 20% of the entire lot within the shoreland zone. However, if a property owner wants to exceed the cap, a conditional use permit or administrative staff review is required.
- F. Combination of B and C - Impervious surfaces shall not exceed 2,500 square feet or 20% of the entire lot within the shoreland zone unless best management practices are implemented to control 90% of the post construction runoff.

# Impervious Surface Options

## *A Review*

# Options A + B

20% of 20,000 sq. ft. lot

## Example

1500 sq. ft. house footprint

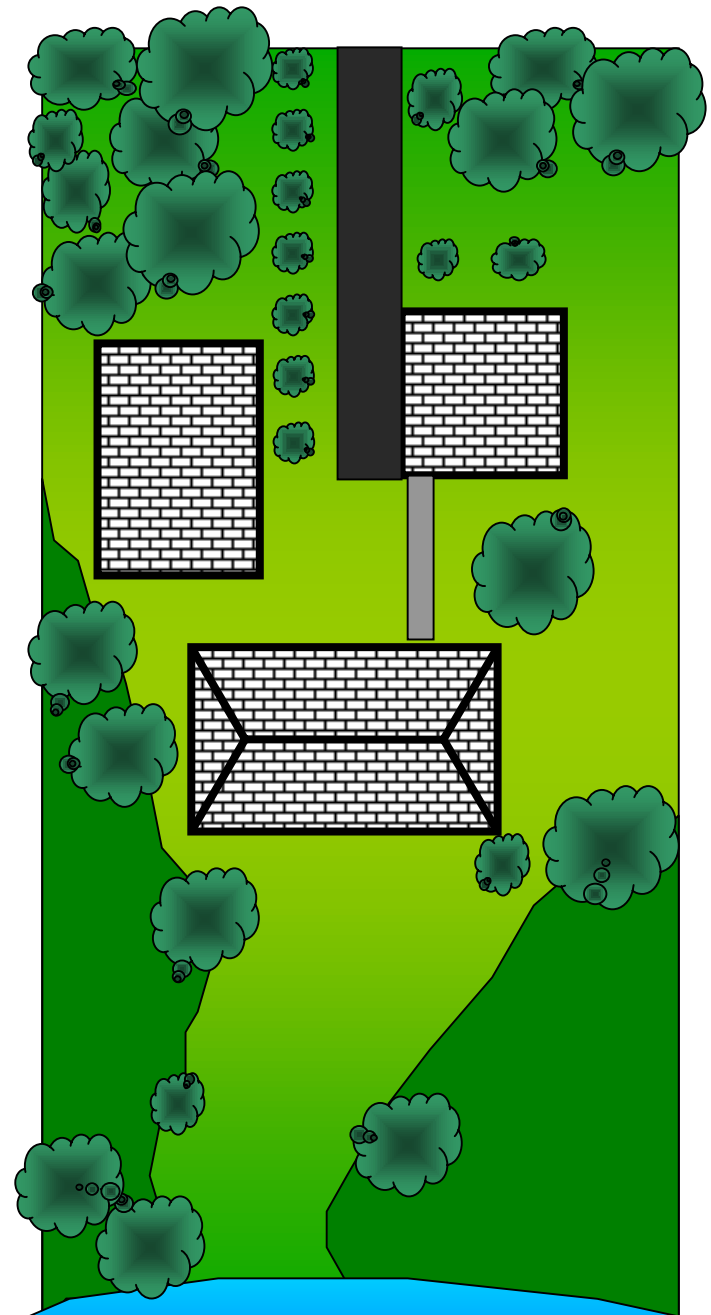
740 sq. ft. garage

660 sq. ft. driveway

100 sq. ft. sidewalk

+ 1000 sq. ft. shed

4000 sq. ft. total



# Options A + B

20% of 40,000 sq. ft. lot

## Example

2500 sq. ft. house  
footprint

740 sq. ft. garage

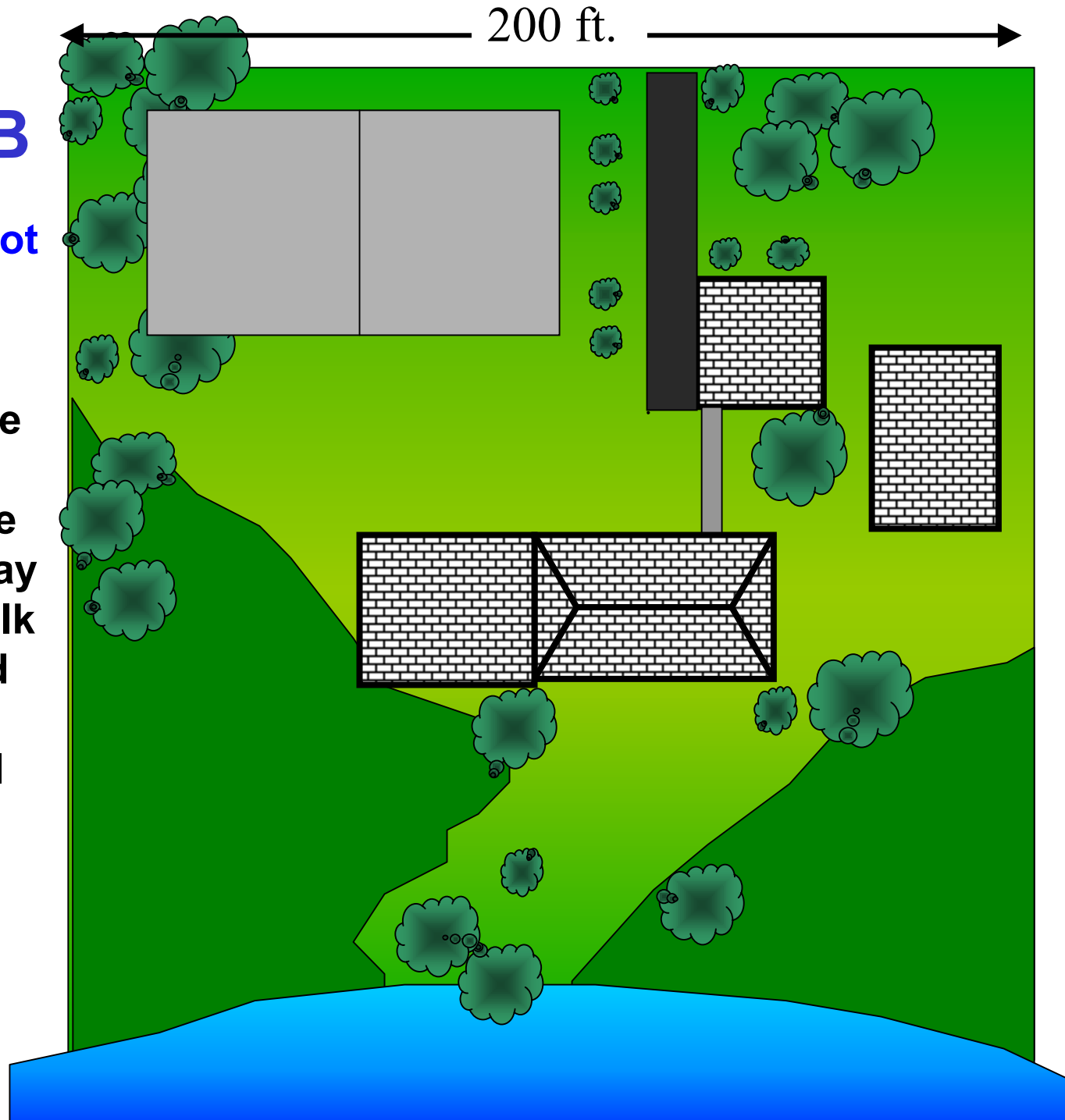
660 sq. ft. driveway

100 sq. ft. sidewalk

1000 sq. ft. shed

3000 sf court

8000 sq. ft. total

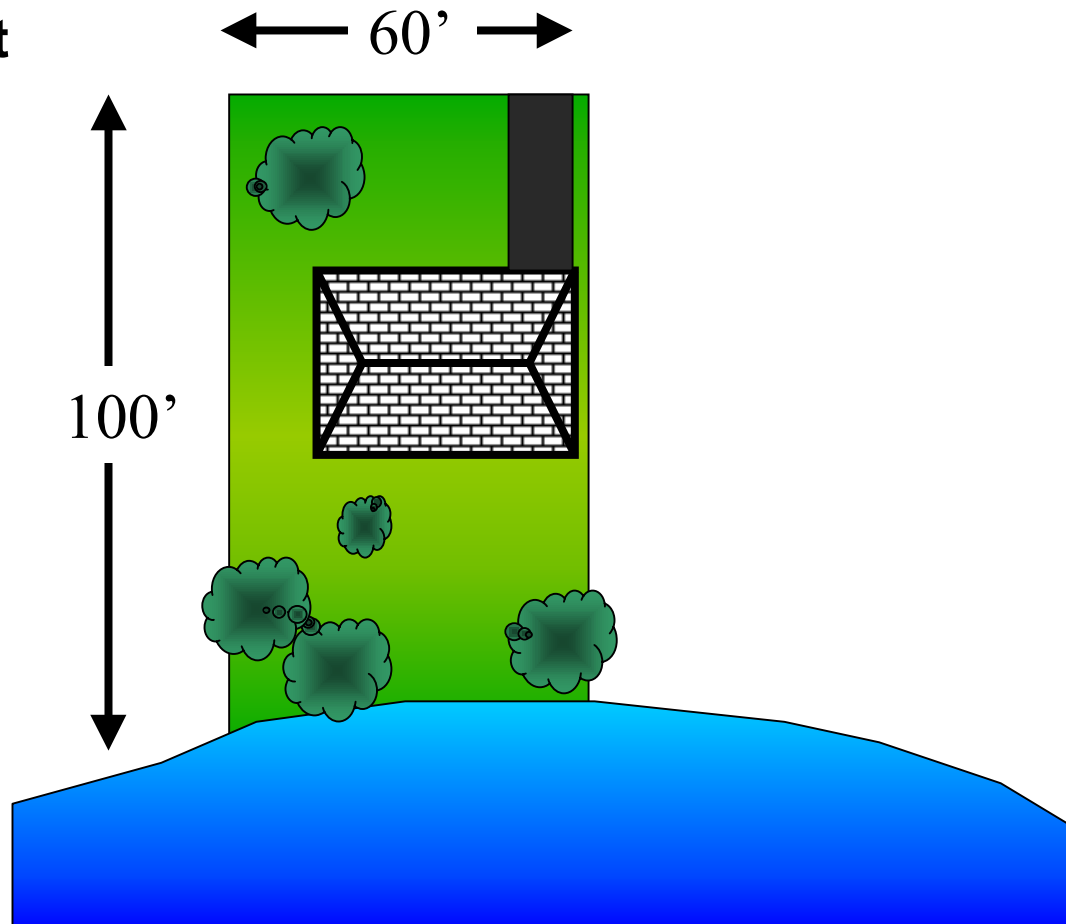


# Option A

20% of 6,000 sq. ft. lot

## Example

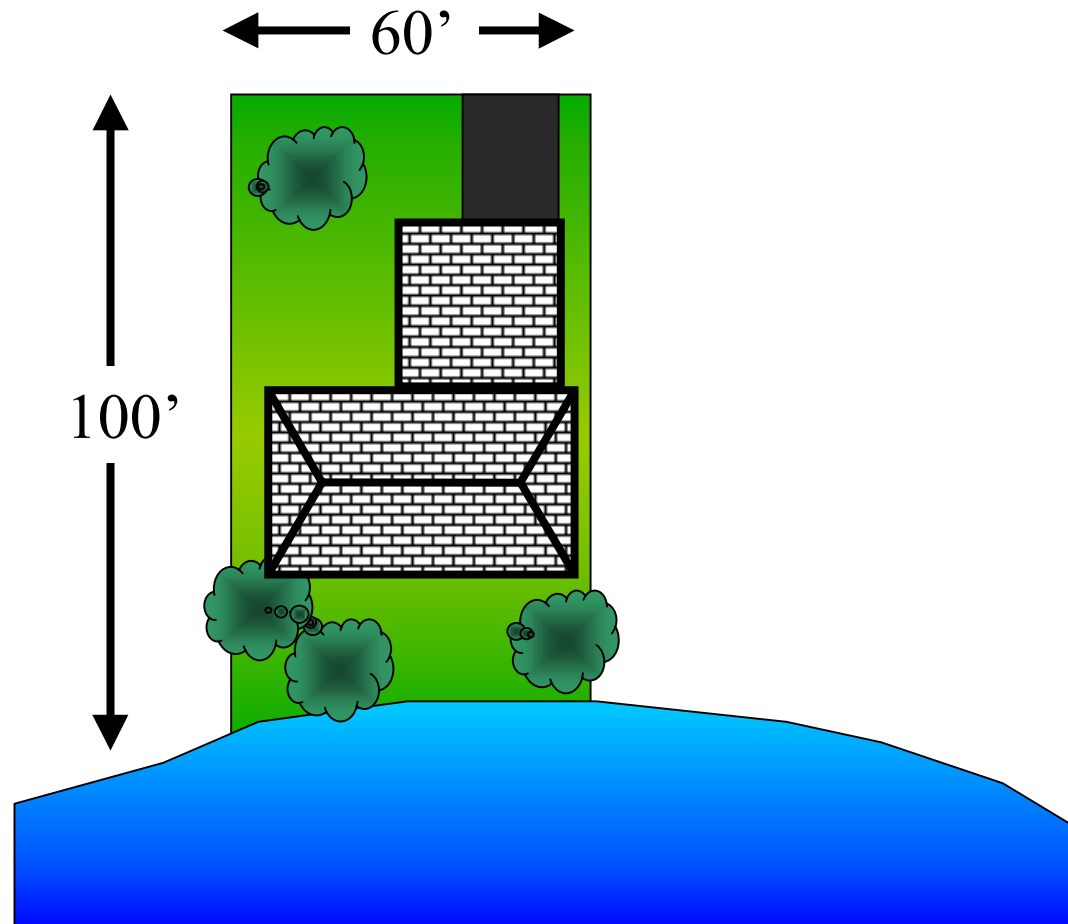
1000 sq. ft. house footprint  
+ 200 sq. ft. driveway  
1200 sq. ft. total



# Option B

**20% or 2500 sf, whichever is  
greater of 6,000 sq. ft. lot**

**1500 sq. ft. house  
footprint  
740 sq. ft. garage  
+ 260 sq. ft. driveway  
2500 sq. ft. total = 62%**



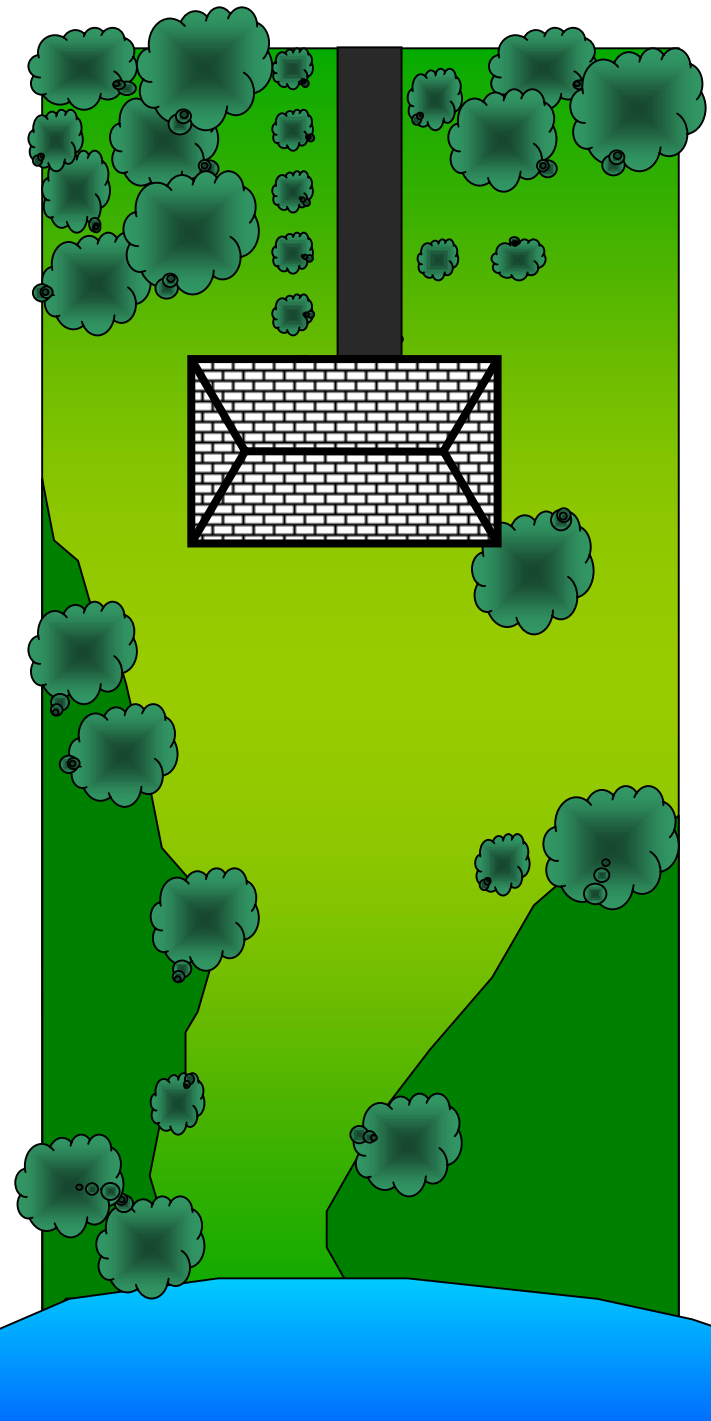
# Option C

**5% of 20,000 sq. ft. lot UNLESS best management practices are implemented to control 90% of the post-development runoff**

## Example

**800 sq. ft. house footprint  
+ 200 sq. ft. driveway**

**1000 sq. ft. total unless BMP's  
are used to control 90% of the  
runoff**





# Option D

No impervious surface cap

